

What is claimed is:

1. A burn through and flame propagation resistant laminate, comprising:
 - a sheet of burn through and flame propagation resistant paper comprising: aramid fibers, mica flakes, and aramid fibrid binder; and
 - a first sheet of polymeric film having a first major surface bonded to a first major surface of the sheet of burn through and flame propagation resistant paper and forming, with the sheet of burn through and flame propagation resistant paper, a laminated sheet.
2. The burn through and flame propagation resistant laminate according to claim 1, wherein:
the sheet of burn through and flame propagation resistant paper has from about 30% to about 50% by weight mica.
3. The burn through and flame propagation resistant laminate according to claim 1, wherein:
the sheet of burn through and flame propagation resistant paper is treated with a fluorocarbon to make the sheet of burn through and flame propagation resistant paper more water repellent.
4. The burn through and flame propagation resistant laminate according to claim 1, wherein:
the first sheet of polymeric film is a water vapor transmission resistant film having a water vapor permeability of 4.0 perms or less.
5. The burn through and flame propagation resistant laminate according to claim 1, wherein:
the first sheet of polymeric film is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less.
6. The burn through and flame propagation resistant laminate according to claim 1, wherein:
the first sheet of polymeric film is a water vapor transmission and flame propagation resistant polymeric film, having a water vapor permeability of 4.0 perms or less, selected from a group consisting of polyvinylfluoride and polyimide films.

7. The burn through and flame propagation resistant laminate according to claim 1, wherein:

a second major surface of the first sheet of polymeric film is coated with a heat sealable adhesive.

8. The burn through and flame propagation resistant laminate according to claim 1, wherein:

a second major surface of the sheet of burn through and flame propagation resistant paper is coated with a heat sealable adhesive.

9. The burn through and flame propagation resistant laminate according to claim 1, wherein:

the laminated sheet is reinforced with scrim to increase the puncture and tear resistance of the laminated sheet.

10. The burn through and flame propagation resistant laminate according to claim 1, wherein:

the first sheet of polymeric film is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and

a second major surface of the first sheet of polymeric film is coated with a heat sealable adhesive.

11. The burn through and flame propagation resistant laminate according to claim 10, including:

a sheet of scrim bonded by the coating of heat sealable adhesive to the polymeric film to increase the puncture and tear resistance of the laminated sheet.

12. The burn through and flame propagation resistant laminate according to claim 1, wherein:

the first sheet of polymeric film is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and

a second major surface of the sheet of burn through and flame propagation resistant paper is coated with a heat sealable adhesive.

13. The burn through and flame propagation resistant laminate according to claim 12, including:

a sheet of scrim bonded by the coating of heat sealable adhesive to the burn through and flame propagation resistant paper of the laminated sheet to increase the puncture and tear resistance of the laminated sheet.

14. The burn through and flame propagation resistant laminate according to claim 1, including:

a second sheet of polymeric film having a first major surface bonded to a second major surface of the sheet of burn through and flame propagation resistant paper; and

at least one of the first and second sheets of polymeric film being flame propagation and water vapor transmission resistant and having a water vapor permeability of 4.0 perms or less.

15. The burn through and flame propagation resistant laminate according to claim 14, wherein:

the sheet of burn through and flame propagation resistant paper has from about 30% to about 50% by weight mica.

16. The burn through and flame propagation resistant laminate according to claim 14, wherein:

the sheet of burn through and flame propagation resistant paper is treated with a fluorocarbon to make the sheet of burn through and flame propagation resistant paper more water repellent.

17. The burn through and flame propagation resistant laminate according to claim 14, wherein:

a second major surface of the first sheet polymeric film is coated with a heat sealable adhesive.

18. The burn through and flame propagation resistant laminate according to claim 14, wherein:

second major surfaces of the first and second sheets of polymeric film are coated with a heat sealable adhesive.

19. The burn through and flame propagation resistant laminate according to claim 14, wherein:

the laminated sheet is reinforced with scrim to increase the puncture and tear resistance of the laminated sheet.

20. A burn through and flame propagation resistant insulation system comprising:

a burn through and flame propagation resistant laminated sheet; the laminated sheet including a sheet of burn through and flame propagation resistant paper comprising: aramid fibers, mica flakes, and aramid fibrid binder; and a first sheet of polymeric film having a first major surface bonded to a first major surface of the sheet of burn through and flame propagation resistant paper;

a layer of lightweight, flexible, thermal and acoustical insulation material; the layer of insulation material having first and second major surfaces; and

the laminated sheet overlaying a major surface of the layer of insulation material.

21. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a glass fiber insulation material.

22. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a polyimide foam insulation material.

23. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet has from about 30% to about 50% by weight mica.

24. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet is treated with a fluorocarbon to make the sheet of burn through and flame propagation resistant paper more water repellent.

25. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission resistant film having a water vapor permeability of 4.0 perms or less.

26. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less.

27. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film, having a water vapor permeability of 4.0 perms or less, selected from a group consisting of polyvinylfluoride and polyimide films.

28. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

a second major surface of the first sheet of polymeric film of the laminated sheet is coated with a heat sealable adhesive.

29. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

a second major surface of the sheet of burn through and flame propagation resistant paper of the laminated sheet is coated with a heat sealable adhesive.

30. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the laminated sheet includes a reinforcing scrim to increase the puncture and tear resistance of the laminated sheet.

31. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and

a second major surface of the first sheet of polymeric film of the laminated sheet is coated with a heat sealable adhesive.

32. The burn through and flame propagation resistant insulation system according to claim 31, including:

a sheet of scrim bonded by the coating of heat sealable adhesive to the polymeric film of the laminated sheet to increase the puncture and tear resistance of the laminated sheet.

33. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and

a second major surface of the sheet of burn through and flame propagation resistant paper of the laminated sheet is coated with a heat sealable adhesive.

34. The burn through and flame propagation resistant insulation system according to claim 33, including:

a sheet of scrim bonded by the coating of heat sealable adhesive to the burn through and flame propagation resistant paper of the laminated sheet to increase the puncture and tear resistance of the laminated sheet.

35. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the laminated sheet includes a second sheet of polymeric film having a first major surface bonded to a second major surface of the sheet of burn through and flame propagation resistant paper; and

at least one of the first and second sheets of polymeric film are flame propagation and water vapor transmission resistant and having a water vapor permeability of 4.0 perms

or less.

36. The burn through and flame propagation resistant insulation system according to claim 35, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet has from about 30% to about 50% by weight mica.

37. The burn through and flame propagation resistant insulation system according to claim 35, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet is treated with a fluorocarbon to make the sheet of burn through and flame propagation resistant paper more water repellent.

38. The burn through and flame propagation resistant insulation system according to claim 35, wherein:

a second major surface of the first sheet polymeric film is coated with a heat sealable adhesive.

39. The burn through and flame propagation resistant insulation system according to claim 35, wherein:

second major surfaces of the first and second sheets of polymeric film of the laminated sheet are coated with a heat sealable adhesive.

40. The burn through and flame propagation resistant insulation system according to claim 35, wherein:

the laminated sheet includes a reinforcing scrim to increase the puncture and tear resistance of the laminated sheet.

41. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the system is located within a cavity of an aircraft fuselage; the cavity having an outboard side formed by an outer metal skin and framework and an inboard side formed by cabin trim panels; and

the laminated sheet is located intermediate the insulation layer of the insulation system and the outboard side of the cavity.

42. The burn through and flame propagation resistant insulation system according to claim 41, wherein:

the insulation layer comprises a plurality of encapsulated insulation assemblies.

43. The burn through and flame propagation resistant insulation system according to claim 20, wherein:

the system is located within a cavity of an aircraft fuselage; the cavity having an outboard side formed by an outer metal skin and framework and an inboard side formed by cabin trim panels; and

the laminated sheet is located intermediate the insulation layer of the insulation system and the inboard side of the cavity.

44. The burn through and flame propagation resistant insulation system according to claim 43, wherein:

the insulation layer comprises a plurality of encapsulated insulation assemblies.

45. A burn through and flame propagation resistant insulation system comprising:

an envelope formed of a burn through and flame propagation resistant laminated sheet; the laminated sheet including a sheet of burn through and flame propagation resistant paper comprising: aramid fibers, mica flakes, and aramid fibrid binder; and a first sheet of polymeric film having a first major surface bonded to a first major surface of the sheet of burn through and flame propagation resistant paper;

a layer of lightweight, flexible, thermal and acoustical insulation material contained within the envelope.

46. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a glass fiber insulation material.

47. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a polyimide foam insulation material.

48. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet has from about 30% to about 50% by weight mica.

49. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet is treated with a fluorocarbon to make the sheet of burn through and flame propagation resistant paper more water repellent.

50. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission resistant film having a water vapor permeability of 4.0 perms or less.

51. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and the first sheet of polymeric film forms an outer surface of the envelope to restrict the transmission of water vapor into the burn through and flame propagation resistant paper and the insulation layer.

52. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film, having a water vapor permeability of 4.0 perms or less, selected from a group consisting of polyvinylfluoride and polyimide films; and the first sheet of polymeric film forms an outer surface of the envelope to restrict the transmission of water vapor into the burn through and flame propagation resistant paper and the insulation layer.

53. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

a second major surface of the first sheet of polymeric film of the laminated sheet is coated with a heat sealable adhesive.

54. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

a second major surface of the sheet of burn through and flame propagation resistant paper of the laminated sheet is coated with a heat sealable adhesive.

55. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the laminated sheet includes a reinforcing scrim to increase the puncture and tear resistance of the laminated sheet.

56. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and

a second major surface of the first sheet of polymeric film of the laminated sheet is coated with a heat sealable adhesive.

57. The burn through and flame propagation resistant insulation system according to claim 56, including:

a sheet of scrim bonded by the coating of heat sealable adhesive to the polymeric film of the laminated sheet to increase the puncture and tear resistance of the laminated sheet.

58. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the first sheet of polymeric film of the laminated sheet is a water vapor transmission and flame propagation resistant polymeric film having a water vapor permeability of 4.0 perms or less; and

a second major surface of the sheet of burn through and flame propagation resistant paper of the laminated sheet is coated with a heat sealable adhesive.

59. The burn through and flame propagation resistant insulation system according to claim 58, including:

a sheet of scrim bonded by the coating of heat sealable adhesive to the burn through and flame propagation resistant paper of the laminated sheet to increase the puncture and tear resistance of the laminated sheet.

60. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the laminated sheet includes a second sheet of polymeric film having a first major surface bonded to a second major surface of the sheet of burn through and flame propagation resistant paper; and

at least one of the first and second sheets of polymeric film are flame propagation and water vapor transmission resistant and having a water vapor permeability of 4.0 perms or less.

61. The burn through and flame propagation resistant insulation system according to claim 60, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet has from about 30% to about 50% by weight mica.

62. The burn through and flame propagation resistant insulation system according to claim 60, wherein:

the sheet of burn through and flame propagation resistant paper of the laminated sheet is treated with a fluorocarbon to make the sheet of burn through and flame propagation resistant paper more water repellent.

63. The burn through and flame propagation resistant insulation system according to claim 60, wherein:

a second major surface of the first sheet polymeric film is coated with a heat sealable adhesive.

64. The burn through and flame propagation resistant insulation system according to claim 60, wherein:

the second major surfaces of the first and second sheets of polymeric film of the laminated sheet are coated with a heat sealable adhesive.

65. The burn through and flame propagation resistant insulation system according to claim 60, wherein:

the laminated sheet includes a reinforcing scrim to increase the puncture and tear resistance of the laminated sheet.

66. The burn through and flame propagation resistant insulation system according to claim 45, wherein:

the system is located within a cavity of an aircraft fuselage; the cavity having an outboard side formed by an outer metal skin and framework and an inboard side formed by cabin trim panels.

67. A burn through, flame propagation and water vapor transmission resistant sheet, comprising:

a sheet of burn through and flame propagation resistant paper having first and second major surfaces and comprising: aramid fibers, mica flakes, and aramid fibrid binder; the sheet of burn through and flame propagation resistant paper having the first major surface treated with a heat sealable, moisture and flame propagation resistant polyvinylfluoride water based emulsion coating and having a water vapor permeability of 4.0 perms or less.

68. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 67, wherein:

the sheet of burn through and flame propagation resistant paper has from about 30% to about 50% by weight mica.

69. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 67, wherein:

the polyvinylfluoride coating, by dry weight, is between 20 and 100 g/m².

70. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 67, including:

a sheet of reinforcing scrim bonded to one of the major surfaces of the sheet of burn through and flame propagation resistant paper to increase the puncture and tear resistance of the burn through, flame propagation and water vapor transmission resistant sheet.

71. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 67, including:

a sheet of reinforcing scrim bonded by the heat sealable polyvinylfluoride coating to the first major surface of the sheet of burn through and flame propagation resistant paper to increase the puncture and tear resistance of the burn through, flame propagation and water vapor transmission resistant sheet.

72. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 67, wherein:

the sheet of burn through and flame propagation resistant paper having a second major surface treated with a heat sealable, moisture and flame propagation resistant polyvinylfluoride water based emulsion coating.

73. A burn through, flame propagation and water vapor transmission resistant insulation system comprising:

a burn through, flame propagation and water vapor transmission resistant sheet comprising a sheet of burn through and flame propagation resistant paper having first and second major surfaces and comprising: aramid fibers, mica flakes, and aramid fibrid binder; the sheet of burn through and flame propagation resistant paper having the first major surface treated with a heat sealable, moisture and flame propagation resistant polyvinylfluoride water based emulsion coating and having a water vapor permeability of 4.0 perms or less;

a layer of lightweight, flexible, thermal and acoustical insulation material; the layer of insulation material having first and second major surfaces; and

the burn through, flame propagation and water vapor transmission resistant sheet overlaying a major surface of the layer of insulation material.

74. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, wherein:

the sheet of burn through and flame propagation resistant paper has from about 30% to about 50% by weight mica.

75. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, wherein:

the heat sealable polyvinylfluoride coating, by dry weight, is between 20 and 100 g/m².

76. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, including:

a sheet of reinforcing scrim bonded to one of the major surfaces of the sheet of burn through and flame propagation resistant paper to increase the puncture and tear resistance of the burn through, flame propagation and water vapor transmission resistant sheet.

77. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, including:

a sheet of reinforcing scrim bonded by the heat sealable polyvinylfluoride coating to the first major surface of the sheet of burn through and flame propagation resistant paper to increase the puncture and tear resistance of the burn through, flame propagation and water vapor transmission resistant sheet.

78. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 73, wherein:

the sheet of burn through and flame propagation resistant paper has a second major surface treated with a heat sealable, moisture and flame propagation resistant polyvinylfluoride water based emulsion coating.

79. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a glass fiber insulation material.

80. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a polyimide foam insulation material.

81. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, wherein:

the system is located within a cavity of an aircraft fuselage; the cavity having an outboard side formed by an outer metal skin and framework and an inboard side formed by cabin trim panels; and

the burn through, flame propagation and water vapor transmission resistant sheet is located intermediate the insulation layer of the insulation system and the outboard side of the cavity.

82. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 81, wherein:

the insulation layer comprises a plurality of encapsulated insulation assemblies.

83. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 73, wherein:

the system is located within a cavity of an aircraft fuselage; the cavity having an outboard side formed by an outer metal skin and framework and an inboard side formed by cabin trim panels; and

the burn through, flame propagation and water vapor transmission resistant sheet is located intermediate the insulation layer of the insulation system and the inboard side of the cavity.

84. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 83, wherein:

the insulation layer comprises a plurality of encapsulated insulation assemblies.

85. A burn through and flame propagation resistant insulation system comprising:

an envelope formed of a burn through, flame propagation and water vapor transmission resistant sheet; the burn through, flame propagation and water vapor transmission resistant sheet comprising a sheet of burn through and flame propagation resistant paper having first and second major surfaces and comprising: aramid fibers, mica

flakes, and aramid fibrid binder; the sheet of burn through and flame propagation resistant paper having the first major surface treated with a heat sealable, moisture and flame propagation resistant polyvinylfluoride water based emulsion coating and having a water vapor permeability of 4.0 perms or less;

a layer of lightweight, flexible, thermal and acoustical insulation material contained within the envelope.

86. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, wherein:

the sheet of burn through and flame propagation resistant paper has from about 30% to about 50% by weight mica.

87. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, wherein:

the heat sealable polyvinylfluoride coating, by dry weight, is between 20 and 100 g/m².

88. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, including:

a sheet of reinforcing scrim bonded to one of the major surfaces of the sheet of burn through and flame propagation resistant paper to increase the puncture and tear resistance of the burn through, flame propagation and water vapor transmission resistant sheet.

89. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, including:

a sheet of reinforcing scrim bonded by the heat sealable polyvinylfluoride coating to the first major surface of the sheet of burn through and flame propagation resistant paper to increase the puncture and tear resistance of the burn through, flame propagation and water vapor transmission resistant sheet.

90. The burn through, flame propagation and water vapor transmission resistant sheet according to claim 85, wherein:

the sheet of burn through and flame propagation resistant paper has a second major surface treated with a heat sealable, moisture and flame propagation resistant polyvinylfluoride water based emulsion coating.

91. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a glass fiber insulation material.

92. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, wherein:

the layer of lightweight, flexible, thermal and acoustical insulation material is a polyimide foam insulation material.

93. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, wherein:

the system is located within a cavity of an aircraft fuselage; the cavity having an outboard side formed by an outer metal skin and framework and an inboard side formed by cabin trim panels.

94. The burn through, flame propagation and water vapor transmission resistant insulation system according to claim 85, wherein:

the heat sealable polyvinylfluoride coating forms an outer surface of the envelope to restrict the transmission of water vapor into the burn through and flame propagation resistant paper and the insulation layer.